BRITISH MEDICAL JOURNAL

LONDON SATURDAY OCTOBER 2 1937

CONSERVATIVE TREATMENT OF CANCER OF THE BREAST*

BY

GEOFFREY KEYNES, M.A., M.D.Camb., F.R.C.S.

Assistant Surgeon, St. Bartholomew's Hospital; Surgeon, Mount Vernon Hospital, Northwood

(WITH SPECIAL PLATE)

It is now nearly fifty years since William Stewart Halsted of Baltimore introduced the radical operation for the treatment of cancer of the breast. The technique of the operation has undergone modification during that period, but Halsted's principle has been accepted throughout the world of surgery, and for many years the radical operation has been more or less standardized. Moreover, the degree of standardization has been some indication of the satisfaction with which surgeons have regarded the results that have been achieved. The satisfaction has been only relative, because treatment of cancer in all parts of the body has been disappointing. The treatment of cancer in the breast has perhaps been less disappointing than in most other positions.

Standardization must not, however, be allowed to create a fixed belief that no further improvement is possible and that any suggested change is necessarily to be regarded with disapproval. Most surgeons who have taken the trouble to follow up their patients after performing the radical operation for cancer of the breast are indeed gravely dissatisfied with their results. I have described elsewhere (Keynes, 1929, 1932) the earlier stages of an attempt to find out whether irradiation with interstitial radium needles might be used to mitigate or possibly abolish the necessity for so drastic a form of treatment as the radical operation. The present communication embodies the late results obtained in a longer series of patients treated with interstitial radium than has hitherto been recorded. Encouragement is to be obtained from a survey of the present treatment of cancer in general, for irradiation has virtually supplanted surgical operation in cancer of the tongue, mouth, and fauces, and in cancer of the cervix uteri. At one time there was a widespread belief that cancer of the breast is not a radiosensitive neoplasm, and it was stated, particularly in some clinics on the continent of Europe, that satisfactory irradiation of the contents of the axilla is impossible. These statements I believe to be untrue, and a test is provided by the late results of irradiation as presented here.

From the ordinary surgical standpoint it is exceedingly unorthodox to suggest that conservative methods of treatment, sometimes without any removal of tissue whatever, could possibly be better than radical operation, or even as good. I used to maintain myself that the earlier the disease the more radical should the operation be, since the hope of curing the disease was greater; and I was aghast when some of the older surgeons, such as the late Sir Anthony Bowlby of my hospital, expressed their belief that the patients would do just as well if only a local removal of the breast were performed. I must confess that my opinion has now gone to the opposite extreme, and I am prepared to maintain that if the axillary lymph nodes are extensively infected dissection of the axilla may be harmful, and that if they do not appear to be infected it is unnecessary, *provided that radical irradiation is carried out in every patient.* I have also to confess that I have had increasing difficulty in accepting any theory of lymphatic permeation by cancer cells, since so many of its implications seem to be contrary to experience and to common sense. I have been greatly interested, therefore, in anatomical investigations on lymphatics carried out recently at St. Bartholomew's and University College Hospitals by J. H. Gray (1936, 1936a) under the inspiration of Professor H. H. Woollard. By the use of thorotrast and barium lymphatics have been made visible and their course traced more accurately than before, and it has been shown that there are no lymphatic plexuses in the deep fascial layers. Thus the lymphatic system of the breast lies in the gland and on its surface, the main lymphatic trunks passing round the fold of the axilla to the axillary nodes. No evidence whatever has been discovered in support of the theory of centrifugal permeation. On the other hand normal lymphatic channels are found to connect a carcinoma with infected nodes, the only possible inference being that carcinoma cells pass to the nodes as emboli, usually without forming intermediate points of growth. The supposed permeated channels have been shown to be generally infiltration in planes of tissue cleavage, or sometimes to be growth in a venule. It follows, therefore, that widespread operations based upon the permeation theory of lymphatics in fascial planes have no real justification. If Gray's observations are correct it will be necessary to revise our conception of the spread of cancer, and then perhaps the idea of conservative treatment of cancer of the breast may become less repugnant to us.

Interstitial Radium Treatment

It was first suggested to me in 1922 by Professor George Gask that an attempt should be made to treat cancer of the breast with interstitial radium alone. For the first two years only patients with recurrent disease following operation were so treated. In nearly every instance the growth was found to disappear, and the method was then extended to the primary disease, the first patient being treated on August 1, 1924. For the next four and a half years only patients with very

* The substance of an address delivered to the American Surgical Association in New York on June 5, 1937.

advanced or inoperable tumours were treated in this way, and the results in fifty of these were examined before it was thought justifiable to extend the procedure to the earlier stages of the disease. It was soon apparent that the belief that cancer cells in the breast were not sensitive to irradiation must be abandoned. Some remarkable results were obtained, and although the majority of these patients are now dead from metastases, many of them remained alive for periods up to eight years without external signs of disease. Six of them are still alive nearly ten years after treatment, and five of the six—that is, 10 per cent. of the whole - are without any signs of disease.

Two of these patients are shown in the illustrations on the Special Plate:

A patient, aged 40 (Fig. 1), came with a large tumour in her left breast which had already produced elevation of the breast and retraction of the nipple. The disease was advanced, though still operable. There were palpable lymph nodes in the axilla. She was treated with radium alone after the diagnosis had been proved by biopsy. The picture illustrates her present condition. There is some contraction of the breast, which followed the disappearance of the tumour, but the patient is without signs of disease ten and a half years after treatment.

A stout patient, aged 57 (Fig. 2), had a very large tumour in the left breast. It was infiltrating the skin and was adherent to the chest wall, so that it was judged inoperable. No secondary disease in the axilla could be detected, but the patient was so stout that large nodes might have been present. She was treated with radium only, and except for a depressed scar in the position of the tumour she shows no trace of her disease nine years later.

When this series of fifty trials of interstitial radium had been completed it was felt to be justifiable to extend the method to treatment of earlier stages of the disease, and from that time to this I have systematically used radium either by itself or in combination with very conservative surgery. The radium has always been applied interstitially in the form of needles, the general principle being illustrated in Fig. 3.

Method of Treatment

The technical details have been described elsewhere (Keynes, 1929, 1932) and need not be repeated here. At the present time the whole breast area is treated with long needles, each containing 3 mg. radium element, placed in parallel series from each side and overlapping in the centre. The axilla is irradiated with from four to seven needles, two of which can be introduced into the apex of the axilla through the pectoral muscles. Care is taken to avoid placing a needle in too close proximity to the neurovascular bundle. Three shorter needles are introduced into the area above the clavicle, and, lastly, one of the shorter needles is placed in each of the upper three or four intercostal spaces. Recently, however, I have felt doubtful about the necessity for intercostal irradiation in most patients, and, as these needles are apt to cause pain, I have been tending to omit them. My experience shows that intercostal recurrence is exceedingly uncommon, and in view of Gray and Woollard's work it seems improbable that lymphatic dissemination takes place readily in that direction in the earlier stages of the disease unless it has started at the periphery of the inner part of the breast. The needles are usually left in position for seven days. No radon has been used. Surgical operation, if employed at all, has preceded irradiation, and has been done with the diathermy needle. No dissection of the axilla has ever been carried out, though occasionally an infected gland close to the axillary tail of the breast has been removed.

The patients were carefully observed, and in due course a certain number of failures were noted. These failures were either shown by incomplete disappearance of the primary tumour or by the appearance of recurrent nodules in the breast or in the skin. In a number of patients these residual tumours were removed and examined nine months or more after the irradiation. It was then found that in 50 per cent. of them no discoverable cancer remained, the tumour consisting entirely of fibrous tissue. In the other 50 per cent. there was evidence of active cancer. This result led to a reconsideration of the procedure, and it was realized that the failures might reasonably be attributed to the physical limitations of radium needles. The penetrating power of the rays is strictly limited, and many of the tumours were too thick and bulky for the gamma rays to penetrate them effectively from below, so that the cancer cells in the centre or at the surface did not receive a lethal dose. Another more theoretical difficulty was the supposed variation in the sensitivity of the cancer cells themselves. I do not attach much importance to the second consideration, but the bulk of the tissue to be irradiated did seem to be a serious obstacle unless the dosage of radium were to be greatly increased, and to this there were other objections. I therefore decided to remove more frequently either the tumour or the breast before irradiation, according to circumstances. Sometimes in the earliest stages of the disease it was desirable to remove the tumour in order to establish the diagnosis. Whenever an operation was done it was as conservative as circumstances would allow, and never was it allowed to extend to removal of the pectoral muscles or dissection of the axilla. In the majority of patients, therefore, the amount of mutilation was negligible, and, for some, radium was still alone employed, without any operation at all. This procedure could only be justified if it was clear that the effect of radium on the axillary lymph nodes was good. It may be stated at once that close observation of the patients over many years has shown that the results in the axilla have been uniformly good. Large axillary nodes have been made to disappear almost with certainty, and they have not recurred. If the axilla did not contain palpable nodes none have developed afterwards. These facts have crystallized the procedure at the present time as follows:

1. Local removal of tumour if it is large or the diagnosis is uncertain, followed by radium.

2. Local removal of the breast if the tumour is very bulky, followed by radium.

3. Never dissect the axilla.

4. Radium by itself may be used: (*a*) if the tumour is of moderate size and the diagnosis certain on clinical grounds; (*b*) if the patient refuses operation.

No patients have been treated without histological proof of the disease unless the diagnosis was quite plain from the clinical signs.

If the disease has extended to the supraclavicular nodes when the patient is first seen, this has usually been found to be accompanied by disease within the thorax, so that the patient will often be unsuitable for treatment by radium, which, like surgical operation, is essentially a local form of treatment. Apart from the obvious necessity of sometimes rejecting those who showed evidence of metastases in viscera or skeleton, there has been no selection of patients.

Statistical Results

Before considering the figures emphasis may again be laid on the fact that interstitial radium treatment is strictly comparable to surgical operation in that it is a local form of treatment, although it can be extended to the area above the clavicle which is not usually included in an operation. For this reason no startling improvement in the survival rate was to be expected if radium were used as an alternative to surgery. It is the metastases, and not the primary disease, that usually cause the death of the patient, and for that reason I never shared the exaggerated hopes that were at one time placed by some people in the future of radium. On the other hand, some local advantages were to be expected if the general results seemed to justify its use.

For statistical purposes I have divided the patients into the usual three groups:

Group I.—Disease apparently confined to breast.

Group II.—Disease apparently confined to breast and axilla.

Group III.—Disease advanced or inoperable.

The statistical results have been very kindly prepared for me by Lady Forber, who, as Miss Janet Lane-Claypon, did so much statistical work on cancer for the Ministry of Health, and reliance may therefore be placed on their accuracy.

The total number of patients treated by me at St. Bartholomew's Hospital, at the Mount Vernon Hospital, Northwood, and privately up to the end of March, 1937, is 325. Of these the patients treated within the last three years must be excluded. This leaves 250 as the total available for statistical examination. They are distributed as follows among the groups: Group I, 85; Group II, 91; Group III, 74. Total, 250.

The net percentage survival rates among my patients have been ascertained by Lady Forber to be as shown in the following table:

	Group	Number	Net Survival	U.C.H. Survival
			%	%
At three years	I	85	83.5	79.2
	II	91	51.2	52.3
	III	74	31.4	—
At five years	I	75	71.4	69.1
	II	66	29.3	30.5
	III	60	23.6	—

Allowance has been made in the third column for patients who died of intercurrent disease, and the figures therefore give the net survival rate. In the fourth column I have added the survival rates obtained as the result of an investigation carried out by W. H. Graham Jessop (1936) at University College Hospital, as this seemed to be the nearest approximation that I could get to a comparable series of a similar number of patients treated by surgery alone.

The only category of really curable patients is that included in Group I, which is therefore the most interesting from the clinical standpoint. Net survival rates in this group of 83.5 per cent. and 71.4 per cent. at three and five years are satisfactory. The University College Hospital series give 79.2 per cent. and 69.1 per cent. for the same periods, and probably it is fair to assume that in round figures 80 per cent. and 70 per cent. may be regarded as average results with the best surgery. My figures for radium are slightly above this average. I should attach no importance to this small difference were it not for the fact that the statistics in this group are weighted heavily against me. When Group I relates to the results obtained by the radical operation the contents of the axilla have been removed and examined histologically, so that those patients having infected nodes which were not clinically palpable have been eliminated. My Group I, on the other hand, is necessarily a clinical group only. There can be no doubt that a proportion of them would prove to have infected nodes if the contents of the axilla were examined. Group I is therefore composed in reality of a mixture of Group I and Group II patients, and is more unfavourable than appears on the surface. Lady Forber tells me that there is insufficient material for forming an accurate basis on which to correct this error in grouping. Such material as there is indicates that the possible error is in the neighbourhood of 27 per cent. She has applied this correction to my series, and she then finds that the corrected survival rate for the patients in Group I is as follows:

Survival Rate in Group I Corrected for Probable Clinical Error

At three years	94.8%
At five years	86.3%

I must confess that these figures surprise me, and they are only published in print with the warning that they contain an element of conjecture. I think it is fair to assume, however, that, if the correction could be accurately made, the true survival rate for Group I patients would be substantially higher than appears in the table given above.

In Group II the survival rates of approximately 51 per cent. and 29 per cent. at three and five years are almost exactly the same as the figures from University College Hospital. In this group so many of the patients are necessarily doomed to die from metastases which have already started when they first come for treatment that little improvement in the survival rate could be expected.

In Group III, where I obtained a survival rate of approximately 31 per cent. and 24 per cent. at three and five years, it is impossible to give any comparable figures from surgery, since so many of the patients are judged, wisely enough, to be inoperable. The survival rate that has been obtained among these patients is the more remarkable when it is remembered that they represent the group that the pure surgeon knows he cannot help; the patients, in fact, that he willingly allows the radiologist to treat.

It has already been mentioned that although none of the patients has been submitted to dissection of the axilla, an increasing number of them have had the tumour or the breast removed before the radium treatment was given. Comparatively few of these, however, come into the five-year or three-year periods, so that the number of patients thus treated is too small to be given separately as percentages. So far as they go the figures now accumulating suggest that there may be a slight further improvement following the preliminary excision, though this cannot yet be asserted with confidence. There will, however, be an improvement in the incidence of secondary minor operations for local recurrences.

The Survival Rate following Radium Treatment

It is perhaps idle to seek at present for any definite cause to account for the apparent rise in the survival rate of Group I patients following radium treatment. I can only point out that the radical operation has a definite operative mortality. It is in the neighbourhood of 3 per cent. according to the University College Hospital figures. Radium, on the other hand, has virtually no operative mortality. Up to the present time only one patient has died while under treatment, and she was found to be suffering from advanced disease of the heart with failure, from which ıe might have died at any moment. This operative mortality would probably militate more against Group II patients suffering from more advanced disease than against Group I. Nevertheless, elimination of this mortality might make a difference of 1 per cent. in Group I. Secondly, the radical operation undoubtedly delivers a knock-out blow, from which many patients do not really recover for a considerable time, and it is possible that their "resistence to the disease" (whatever that may be) is lowered by the shock they suffer. The shock from interstitial radium, on the other hand, is virtually *nil*, so that here again an advantage may result, though this is theoretical. Lastly, there is the complete elimination of surgical interference with the lymphatic system of the axilla. I think it is not impossible that this dissection, as commonly performed, may sometimes disseminate the disease, when it has been temporarily held up in the neighbourhood of the axillary lymph nodes. Interstitial radium, on the other hand, irradiates cancer cells in that position without disturbing them, and this may possibly be a real factor in giving a better survival rate. Again this is theoretical, and I am sure that more knowledge must be obtained concerning the exact mechanism of the dissemination of cancer before the matter can be settled to our satisfaction. This suggestion is put forward, however, particularly in view of the results from the use of radium in Group I, and in view of the work of Gray and Woollard, which these authors think points to dissemination being largely embolic. They even deprecate on this basis any more handling or squeezing of a cancerous breast than is absolutely necessary. I have often wondered in past years, as I watched patients being examined by twenty or thirty students in succession, whether this might not be seriously affecting their expectation of life, and now it seems as if the answer may be in the affirmative. Gray and Woollard are of the opinion that my suggested explanation of the improvement in Group I with radium is probably correct.

Comparison with Radical Surgery

I can lay claim to speak without any anti-surgical bias, since pure surgery is the chief preoccupation of my life. Yet I feel that it must be the ambition of every conscientious surgeon to assist in the gradual elimination of any operation so extensive and severe as the radical operation for cancer of the breast. I cannot help, therefore, being interested in noting what may be achieved, apart from statistics, by the conservative method I have described in comparison with radical surgery. No one can deny that radical surgery often entails, in addition to an appreciable operative mortality, a really hideous mutilation. There is, as a rule, remarkably little limitation of strength and movement of the arm, unless the interference with the axilla results (as it not infrequently does) in an obstruction of the lymphatics of the arm, with its attendant swelling and helplessness. This state of affairs, when it occurs, is very distressing indeed. Again, routine radical surgery does apparently sometimes result in actual dissemination of the disease with widespread recurrences in the skin flaps and their surroundings. It is impossible to escape the conclusion that radical surgery does occasionally do more harm than good. Lastly, and I believe very importantly, there is the psychological aspect. Most women know what is meant by surgical treatment of cancer of the breast, and I am sure that very often they are intimidated by the prospect. Surgeons constantly bewail the fact that patients will not come for treatment soon enough, very often hiding their disease until two years or more have elapsed since it was first noticed. I am afraid it is the fact of surgery that is partly responsible for this attitude on the part of the patients. They are afraid of it, and, frankly, I am not surprised that they should be. It is this feeling that deters them from seeking advice, and so prevents any considerable improvement in the end-results such as might follow earlier diagnosis and earlier treatment in the aggregate.

Advantages of Conservative Treatment

The advantages of conservative treatment such as I have outlined are as follows. The mutilation is usually slight, and very often may truthfully be called negligible. The Special Plate gives a few examples of the present state of patients some time after treatment.

Mrs. B., aged 38 (Fig. 4), had a nodule of growth in the axillary tail of the right breast. It was excised with diathermy, and radium treatment was given in August, 1931. Six years later she is without signs of disease.

Mrs. W., aged 38 (Fig. 5), had a similar history. The lump was excised, and she was given radium treatment only. She also is without signs of disease six years later. There has been some contraction as the result of the disease and the treatment, and the breast is somewhat elevated in comparison with the other.

Mrs. C., aged 34 (Fig. 6), was treated recently by excision of a nodule of cancer in the right breast, and then by radium. Eleven months later the breast is virtually normal.

Mrs. C., aged 61 (Fig. 7), had a small tumour in the upper part of the left breast. The treatment was the same as in Mrs. C. above, and one year later the breast is normal.

There can be no doubt of the aesthetic advantages of conservative treatment.

Mrs. X., aged 39 (Fig. 8), when first seen had a very early carcinoma in the outer part of the right breast. This was treated by excision, followed by radium to the outer half of the breast only. She remained well for nearly five years, and then showed signs of a second carcinoma in the centre of the same breast, with deviation of the nipple. The patient refused operation, and was treated with radium only. Eighteen months after this a very small nodule in the left breast, which had been under observation for some time, became larger, and there was a blood-stained discharge from the nipple. This nodule was excised and proved to be a third carcinoma, and radium was inserted in the breast. The patient now shows some contraction of the right breast, which has had two treatments, but is otherwise quite well more than eight years after being first treated. She would rather have died than submit to removal of a breast, and is unique in my series in having had treatment for three primary growths apparently with success.

With conservative methods there is, as already stated, virtually no operative mortality, and there is never any operative shock. I have never seen lymphatic oedema of the arm which was due to radium. If it occurred, it

was always due to metastatic disease in the thorax. Widespread local recurrences after radium treatment are very uncommon, and they do not ever appear to be attributable to the treatment. Finally, a number of patients have been encouraged to undergo treatment only because they were to be spared the mutilation entailed by surgery. Patients have sometimes said and written to me most moving things in this connexion, and I have no doubt that if conservative treatment were to be commonly practised it would finally have the result of bringing more patients to the benefits of early treatment, and so improve the end-results.

Some Disadvantages

Against these advantages of conservative treatment must be set certain disadvantages. There is, for example, the difficulty of the interpretation of results. I have already mentioned the possibility of there being a residual tumour after treatment by radium alone, and the difficulty of knowing whether this contains active carcinoma or not. In addition to this there is the post-irradiation fibrosis which is apt to appear as long as two years after treatment in the positions where the irradiation has been most intense. It is particularly liable to occur on the inner wall of the axilla, and many of my patients have fibrous lumps in that situation which would unquestionably be diagnosed as recurrent cancer by inexperienced observers. Needless excisions of these lumps and long experience have enabled me to distinguish confidently between fibrosis and recurrence, but it is clear that they introduce real difficulty in the way of widespread adoption of the method. Eighteen months ago I treated a lady for a very early cancer of the breast, and subsequently she returned to South America. Events then took place which greatly alarmed the surgeons in Brazil, and afterwards in Baltimore, though I feel sure in my own mind that the patient did not have a recurrence of carcinoma.

Another disadvantage of the conservative method is the increased liability to neuralgia or "rheumatic" pains in the treated areas. It is true that every woman who has had a cancer of the breast is likely to exaggerate slight pains into worse ones because she always thinks that pain indicates recurrence. Nevertheless, the treated areas do certainly remain for some time more likely to give rise to pain than an operation scar, and the patients are to that extent more conscious of their past experiences. I have never encountered among my patients a true brachial neuritis due to placing needles too close to the brachial nerve trunks. I have seen it produced, however, in another clinic, and it must be remembered that radium needles are dangerous weapons if used with insufficient skill (but so, it may be answered, is a scalpel or almost any of the instruments we are accustomed to use in surgery). Post-irradiation fibrosis may also affect the pectoral muscle and produce some degree of limitation of movement. This is greater when the position of the disease in the breast or axilla necessitates placing a large dose of radium over and under the border of the pectoral muscle. In treating early disease this is not necessary, and the resulting limitation of movement is negligible.

Conclusions

The foregoing account of a clinical investigation, which has now extended over fourteen years, seems to me to show that the treatment of carcinoma of the breast may justifiably be made much more conservative than it usually is, provided that the necessary facilities for irradiation are available. Statistics appear to demonstrate that a definite improvement can be obtained in the most favourable group of patients by judicious use of interstitial radium alone, or of radium combined with very conservative surgery. The rapid improvement in *x*-ray technique now taking place suggests that *x* rays may perhaps be used as an alternative to radium according to circumstances. The treatment here advocated is, however, conservative rather than purely radiological, and details of the technique will no doubt undergo further modification. The general trend of surgery in the treatment of cancer is away from the very extensive operations formerly in vogue, and I believe that this may be found to be true of the future treatment of cancer of the breast. My own results with conservative methods encourage me to proceed in that belief.

REFERENCES

Gray, J. H. (1936). *St. Bart's Hosp. Rep.*, **69**, 322.
—— (1936a). Brit. Emp. Cancer Camp., thirteenth report, p. 34.
Jessop, W. H. Graham (1936). *Lancet*, **2**, 424.
Keynes, G. (1929). *Acta Radiol. Scand.*, **10**, 393.
—— (1932). *Brit. J. Surg.*, **19**, 415.

TUMOURS OF BONE*

RESPONSIBILITIES OF THE PATHOLOGIST

BY

J. S. YOUNG, M.C., M.A., M.D., B.Sc.

Professor of Pathology, Queen's University, and Honorary Pathologist, Royal Victoria Hospital, Belfast

(WITH SPECIAL PLATE)

This is the second occasion within a year on which radiologists, surgeons, and pathologists have met to discuss the same, or very much the same, problem. At the Royal Society of Medicine meeting in January it was urged by the radiologist and by the pathologist that "the closest co-operation must exist between the clinician, pathologist, and radiologist." As I understand it co-operation in diagnosis means nothing more nor less than a fair co-ordination of responsibility, with a spice of mutual understanding and good will. Therefore I should like to summarize at this meeting the responsibilities, as I see them, which rest upon the pathologist in respect of tumours of bone.

1. Correlation of Radiography with Pathology

After every amputation of a limb for a bone tumour, and during every post-mortem examination of a subject in which there is a deep-seated or inaccessible bone tumour, the pathologist should bisect the bone containing the lesion at right angles to the plane of the best radiograph available or in such other plane as will best facilitate the interpretation of the radiographs. This is better done, of course, after consultation with the radiologist. Next the pathologist must determine the histological structure or classification of the growth. And then the radiologist and the pathologist together, with the surgeon if he is interested, should correlate the macroscopical and microscopical appearances of the growth with the radiographs. I need hardly say that the radiographs must be recent if the correlation is to possess any degree of accuracy. If no recent radiographs

* Read in opening a discussion at a joint meeting of the Sections of Pathology, Bacteriology, and Immunology, and of Radiology, at the Annual Meeting of the British Medical Association, Belfast, 1937.

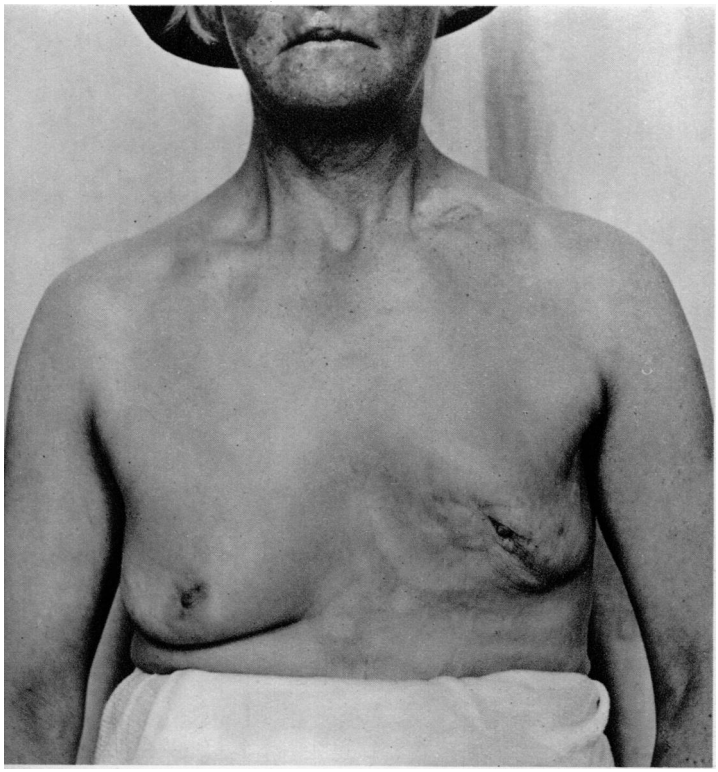

FIG. 1.

FIG. 2.

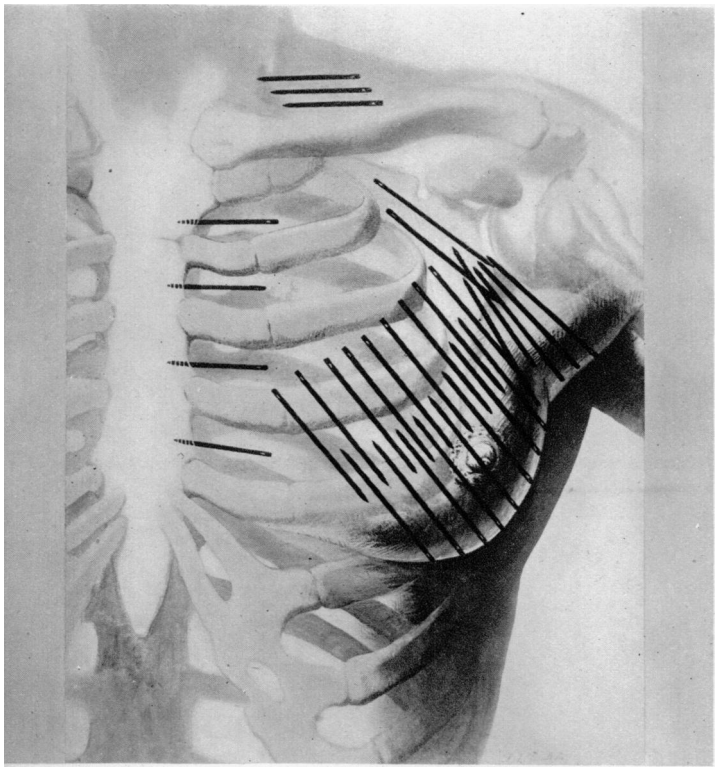

FIG. 3.

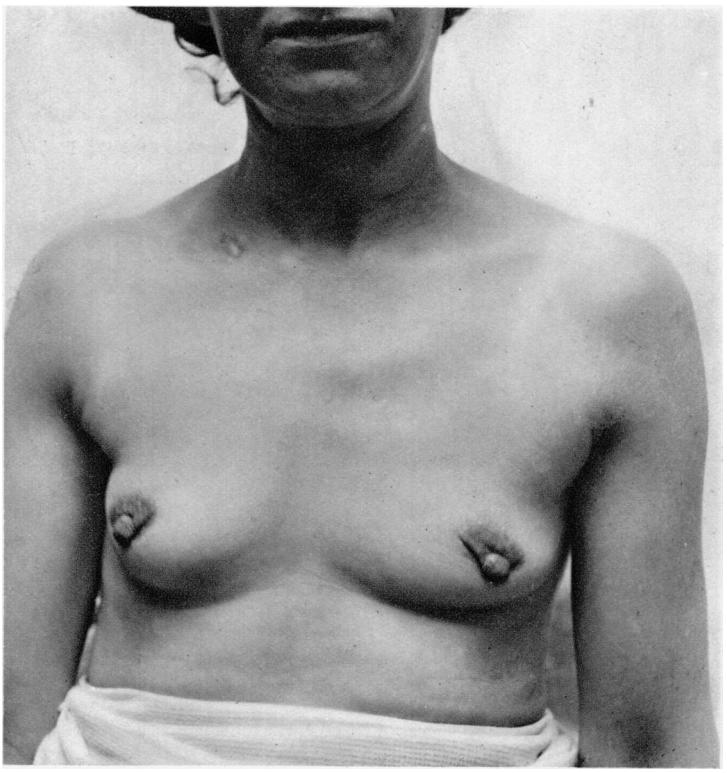

FIG. 4.

GEOFFREY KEYNES: CONSERVATIVE TREATMENT OF CANCER OF THE BREAST

FIG. 5.

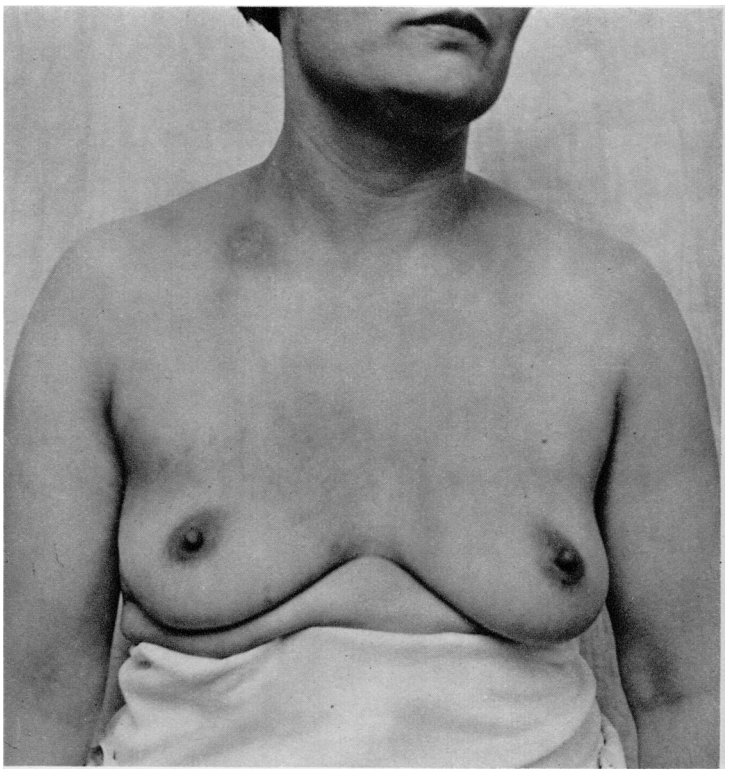

FIG. 6.

FIG. 7.

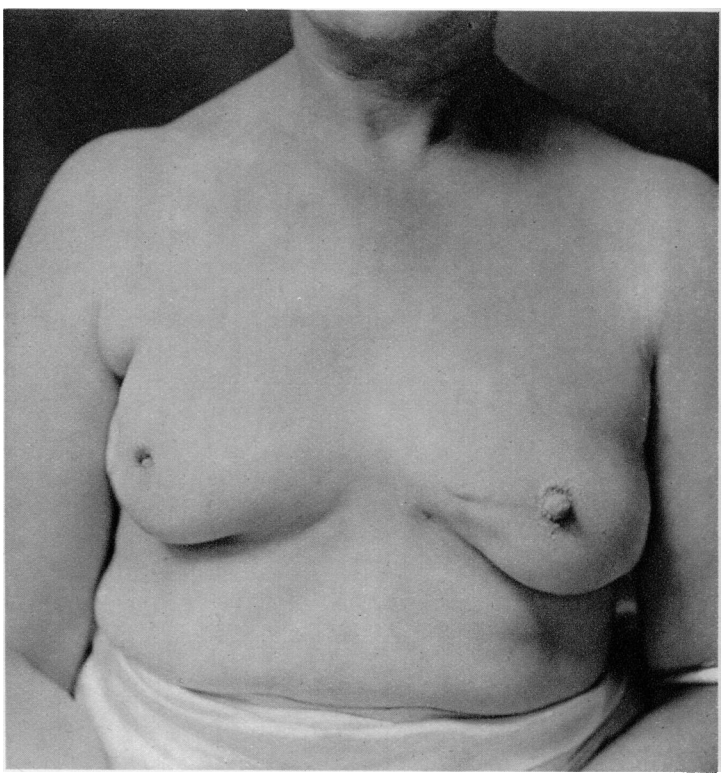

FIG. 8.